



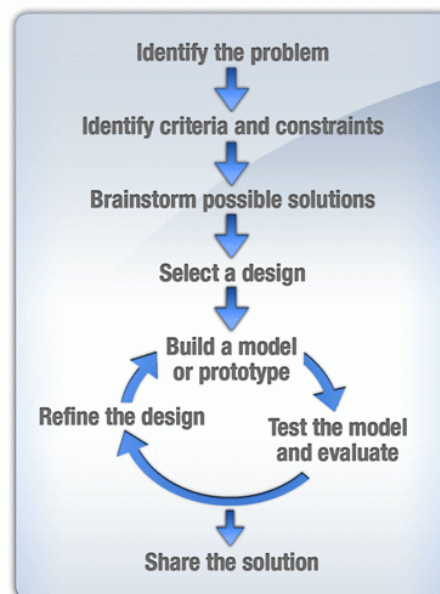
## Steps to Complete the Grades 9-12 OPTIMUS PRIME Spinoff Promotion & Research Challenge (OPSPARC)

For the grades 9-12 *OPTIMUS PRIME Spinoff Promotion & Research Challenge (OPSPARC)* your team will learn about the technology and related Spinoff technology of the James Webb Space Telescope (JWST).

Just like NASA engineers, your team will use an Engineering Design Process (EDP) to design your own Spinoff innovation from JWST technology.

### Background Information:

Before you begin the EDP, you need to know more about *JWST*. Explore the *Research Resources* for background information. Organize your research and thinking in a project notebook like the *High School Design Packet*.



**Action:** *Once you have gathered background information, synthesize and organize an overview of your research within a text box in your Glogster Multimedia Poster (Glog).*

### Step 1: Identify the Problem

- **State the problem clearly.** Select a new Spinoff idea from *JWST* original or Spinoff technology that would help solve a real world problem. To help guide your thinking, consider recording this information in your notebook:
  - What have you learned about *JWST* that may lead to an innovative Spinoff technology that would solve a real world problem? Keep a list of questions you have about *JWST*. Based upon discussions with your team, decide which Spinoff ideas you would like to explore further.
- **Reflection**  
Respond to the following questions in your project notebook.
  1. Which mission and Spinoff ideas did you choose?
  2. What factors did you consider when making your decision?
  3. What are the greatest obstacles you anticipate with designing your own Spinoff innovation?

**Action:** *Identify the Problem in your Glog.*



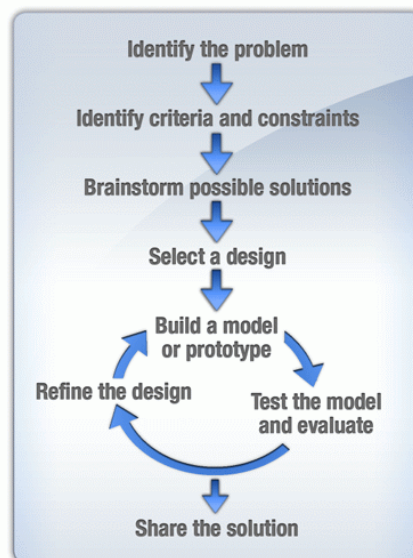
## Step 2: Identify Criteria and Constraints

Now that you identified the problem, it is time to identify the criteria and constraints to consider as you design your own Spinoff innovation.

**Criteria are specific conditions that must be met to solve the problem.**

**Constraints are factors that limit a solution.**

NASA engineers spend years planning and testing to ensure that their designs and innovations satisfy the mission requirements.



- **Review the Design Criteria.** What criteria and constraints should you consider as you design a new Spinoff innovation?
- **Reflection**  
Respond to these questions in your notebook:
  1. In your opinion, which criteria will be the most difficult to meet? Why?
  2. What are some other constraints and criteria to consider? Develop a more complete list of criteria **BEFORE** you begin to design your solution.

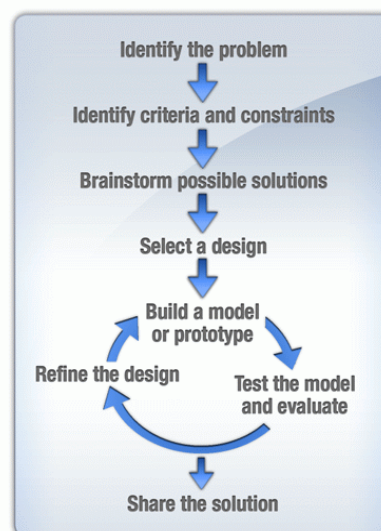
**Action: Identify the Criteria and Constraints in your Glog.**

## Step 3 and 4: Brainstorm and Select a Design

Brainstorm some possible solutions that fit the criteria and constraints. The brainstorming stage is often the most enjoyable step in the problem-solving process. Be creative! Every idea should be recorded and considered.

Don't judge any ideas ... yet.

- **Choose a Design.** As a team, eliminate designs that do not satisfy all of the criteria or modify an existing final design so that it meets the requirements. Discuss the pros and cons of each remaining final design until you can come to an agreement and choose one design.





## Step 3 and 4: Brainstorm and Select a Design (continued)

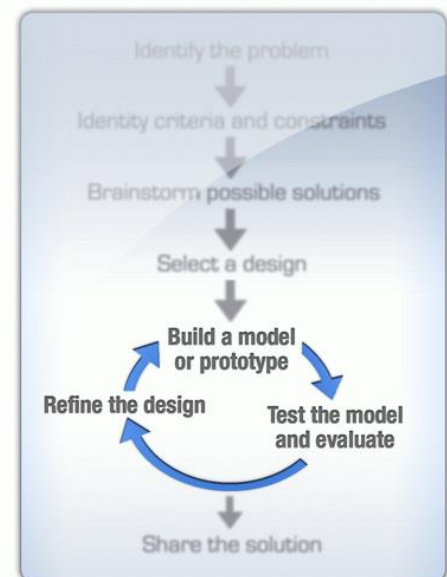
- **Create a Sketch of the Spinoff Innovation.** To complete this brainstorming session, create a realistic drawing of the chosen design. Continue to improve your design concept collaboratively.
- **Reflection**  
Respond to these questions in your notebook:
  1. What makes the design your team has chosen the best? Justify your choice of design by listing the reasons that you selected this design.
  2. What challenges might you face creating the model of this design?

**Action: Include your brainstorming and the selection of your design in your Glog.**

## Step 5, 6, and 7: Build, Evaluate and Refine the Design

In these steps, your team will build or create a simulation of the chosen design. Building a model or simulation allows you to uncover unforeseen challenges and refine your design.

- **Reflection**  
Respond to these questions in your notebook:
  1. Describe your procedure for building the prototype.
  2. After evaluating the prototype, how might you change your design as a result of peer feedback?
  3. What are the strengths of your final design? (Reflect on at least two strengths.)
  4. What are the weaknesses of your final design? (Reflect on at least two weaknesses.)



**Action: Include images or video of this step in your Glog.**



## Step 8: Share your Solution and Final Reflections

Create a video (up to 3 minutes) that explains your innovation of the technology to share your solution with a wider audience.

- **Reflection**

Respond to these questions in your notebook:

1. How did the work that you completed in this challenge compare to the work that all engineers and scientists do?
2. Describe one time during your work when you learned from failure.
3. If you were to begin this challenge again, what would you do differently?
4. How have science and technology pushed innovation?

***Action: Add this video to you Glog.***

***Share your innovation by submitting your completed OPSPARC Glog.***

***Your Glog will be reviewed and possibly selected for TWO next steps. Explore the OPSPARC website to find out more about each selected honor.***

- ***Public Voting***
- ***Moving to InWorld OPSPARC where you will join a virtual world team led by a college engineering student to continue your design with 3D virtual models and simulations.***